REMARKS

Claims 1-41 are pending in this application. All claims have been rejected under 35 U.S.C. § 103. No claims have been amended. Applicants request withdrawal of the rejections based on remarks that follow.

Specification

As an initial matter, the Examiner has requested that Applicants provide the serial numbers of all co-pending applications that are related to the present application. To comply with the Examiner's request Applicants have amended the specification to identify co-pending applications that are generally related to the present application. Applicants have submitted a fuller list of potentially relevant applications in Information Disclosure Statements.

35 U.S.C. § 103 Rejections

Claims 1-41 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of US Published Application No. US 2004/0096672 to Lukas et al. ("Lukas") and Cho et al. "Plasma Treatments of Molecularly Templated Nanoporous Silica Films," ("Cho") which was cited by Applicants in an Information Disclosure Statement. Applicants respectfully traverse this rejection.

Claims 1-24

Independent claim 1 relates to a method of preparing a low-k dielectric material on a substrate involving providing a precursor layer comprising an organic porogen on the substrate and then exposing the precursor layer to a plasma. Importantly, the claim recites that the plasma comprises a silanol capping agent and that the precursor is exposed to the plasma "to remove said porogen from the precursor layer to create voids within the dielectric matrix and concurrently protect the dielectric matrix with hydrophobic groups." Thus, the plasma serves at least two functions, performed concurrently: removing the porogen and protecting the matrix with hydrophobic groups. There are advantages to performing these operations concurrently, including reducing the number of operations required to prepare the dielectric film.

Applicants submit that the claimed invention is patentable over the cited references at least because the references, either alone or in combination, do not teach or suggest 1) exposing the precursor layer to a plasma comprising a silanol capping agent, and 2) concurrently removing the porogen and protecting the matrix with hydrophobic groups.

As acknowledged by the Examiner, while Lukas describes removing a pore-forming phase by exposure to a plasma to form a porous dielectric, it does not disclose a silanol capping agent. Cho describes exposing a dielectric film to an oxygen plasma to remove an organic template, followed by exposing the film to a HMDS vapor, which in turn may be followed by exposing the film to an hydrogen plasma. Although Cho describes exposing the film to plasmas before and after the exposure to the HMDS vapor, nowhere does the reference teach or suggest that the HMDS might be supplied in a plasma. Thus, neither reference teaches or suggest a plasma comprising a silanol capping agent, as required by the claims.

Second, neither reference teaches or suggests concurrently removing the porogen and protecting the matrix with hydrophobic groups. Lukas describes removing a pore-forming phase by exposure to a plasma to form a porous dielectric. While Lukas describes various post-exposure treatment steps for its porous film at paragraphs [0060] through [0072], none of these involve protecting the film with hydrophobic groups.

On page 35 of Cho et al., the authors state that exposure to oxygen plasma oxidizes an organic template such that the "resulting pore surface may be occupied mostly by hydrophilic silanol groups." The authors then state that the surface "can be later modified in HMDS vapor to become hydrophilic." Thus, while Cho may teach sequentially removing a porogen and then protecting the resulting film with hydrophobic groups, there is no teaching or suggestion of concurrently removing porogen from the precursor layer to create voids within the dielectric matrix and protect the dielectric matrix with hydrophobic groups.

At least because the combination of references does not teach or suggest these features of claim 1, Applicants believe claim 1 is patentable over the cited art. Claims 2-24 which depend from claim 1 are also patentable for at least these reasons.

Claims 25-41

Claim 25 also relates to a method of preparing a low-k dielectric material involving exposing a precursor layer containing an organic porogen in a dielectric matrix to a plasma to remove the porogen from the matrix. The claim recites "after removing said organic porogen, exposing the dielectric matrix to a silanol agent, without first exposing the dielectric matrix to

moisture or ambient conditions." As explained in the specification, Applicants recognized the problems encountered in previously known processes, where care was not taken to prevent exposure of the dielectric matrix to moisture or ambient conditions after porogen removal and before exposure to a silanol capping agent. See e.g., page 3, lines 14-18 and page 15, lines 15-23.

Applicants submit that the claimed invention is patentable over the cited references at least because the claimed references, either alone or in combination, do not teach or suggest "after removing said organic porogen, exposing the dielectric matrix to a silanol agent, without first exposing the dielectric matrix to moisture or ambient conditions."

Because Lukas fails to teach or reasonably suggest exposing the dielectric matrix to a silanol capping agent, the Examiner presumably relies on Cho to supply the element "after removing said organic porogen, exposing the dielectric matrix to a silanol agent, without first exposing the dielectric matrix to moisture or ambient conditions."

While Cho may describe removal of porogen (oxygen plasma to remove organic template) and subsequent exposure to a silanol capping agent (exposing the film to HMDS vapor), the reference does not specify that exposing the dielectric matrix to a silanol capping agent occur without first exposing the dielectric matrix to moisture or ambient conditions. It should be noted that Cho specifies that after exposing the silica film to the HMDS vapor, the film is "then moved to the PECVD system," i.e., where the porogen removal took place (page G36, first column). This indicates that the after the organic template is removed, the film is removed from the PECVD chamber for exposure to HMDS vapor. There is no discussion of special procedures taken to assure that the silica film is not exposed to moisture or ambient conditions during the transfer or during exposure to HMDS vapor.

At least because the cited references do not teach or suggest "after removing said organic porogen, exposing the dielectric matrix to a silanol agent, without first exposing the dielectric matrix to moisture or ambient conditions," Applicants believe claim 1 is patentable over the cited art.

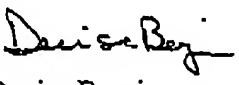
In addition to being patentable for the reasons given above with respect to claim 25, dependent claims 26-41 contain features that are independently patentable. For example, claim 32 specifies that the silanol capping agent is provided in a second plasma. As discussed above with respect to claim 1, neither Lukas nor Cho teach or suggest providing a silanol capping agent in a plasma.

Withdrawal of the 35 U.S.C. § 103(a) rejections of claims 1-41 is respectfully requested.

Conclusion

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,
BEYER WEAVER & THOMAS, LLP



Denise Bergin
Reg. No. 50,581

Tel.: 510-663-1100
P.O. Box 70250
Oakland, CA 94612-0250